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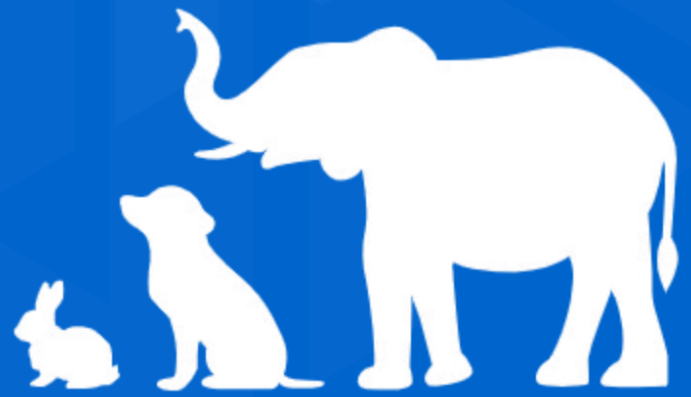
CODING THE "PERFECT" ANIMAL

SBI3U Biology: Evolution



Goals

- Define and use terms related to evolution, such as *speciation*, *genome* and *evolutionary radiation*.
- Understand the concept of evolution and the appearance of new species in history.
- Learn and discuss the factors that affect an animal's evolution.
- Write a code using functions to describe an animal containing the traits necessary to adapt in any environment.
- Discuss and reflect on why a perfect animal does not exist.

WHAT IS EVOLUTION?

- A process in which genetic change occurs in a population over successive generations.

- Normally happens to help an animal adapt to their environment.

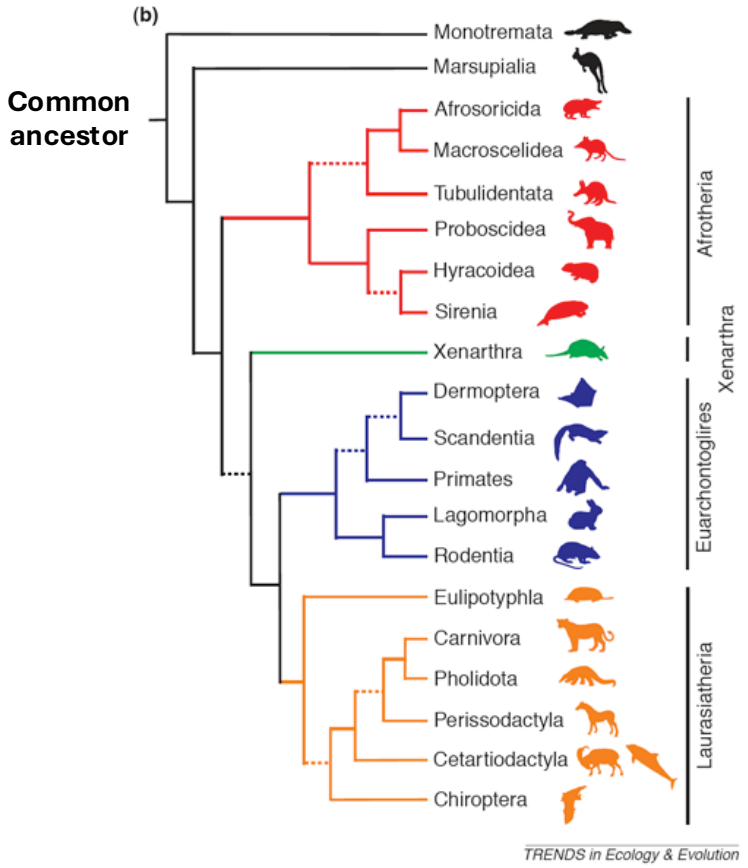
Why are there many animals in the world?

- Evolutionary radiation: an event where a common ancestor evolved into many new species with different traits to adapt in different kinds of environments.

- Speciation = the formation of new species

Evolutionary Radiation

- The extinction of the dinosaurs at the end of the Cretaceous period led to an explosion of diversity of species for mammals.
- With the dinosaurs gone, who were the dominating group during the period, mammals were able to thrive.
- A common ancestor from the mammal group has split into different species suitable for different environments through speciation (check the cladogram on the right).



Charles Darwin and the Finches at the Galapagos Islands

- Different species of birds evolved on different islands with different environmental conditions.
- It is believed that their evolution was based on their diet:
  - If they ate seeds, they had a larger beak.
  - If they ate insects, they had a thinner beak.
  - If they ate fruits, they had a parrot-like beak.

Warbler finch: insect eater

Vegetarian tree finch: fruit eater

Large ground finch: seed eater

Environmental Factors

Animals evolve differently depending on certain factors, such as:

- Temperature
- Climate
- Diet
- Aquatic or terrestrial habitat
- Presence of predators
- Vegetation
- Light level
  - Diurnal or nocturnal
  - Caved or open area

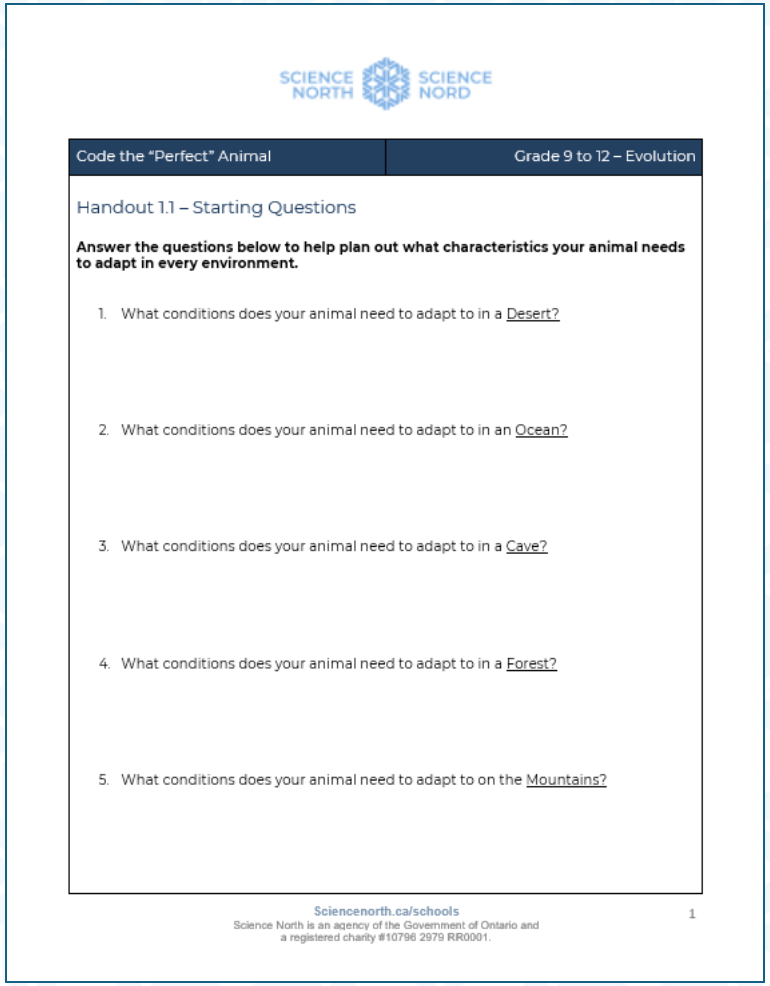
Activity

Goal: Write the genome of an animal containing evolutionary traits needed to adapt in the 5 different types of environments listed below:

- Desert
- Ocean
- Cave
- Forest
- Mountain

Handout 1.1

Answer the questions on the first page of the handout by describing the conditions for each type of environment. Use the environmental factors list previously shown to guide you in your answers.



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Code the "Perfect" Animal	Grade 9 to 12 – Evolution

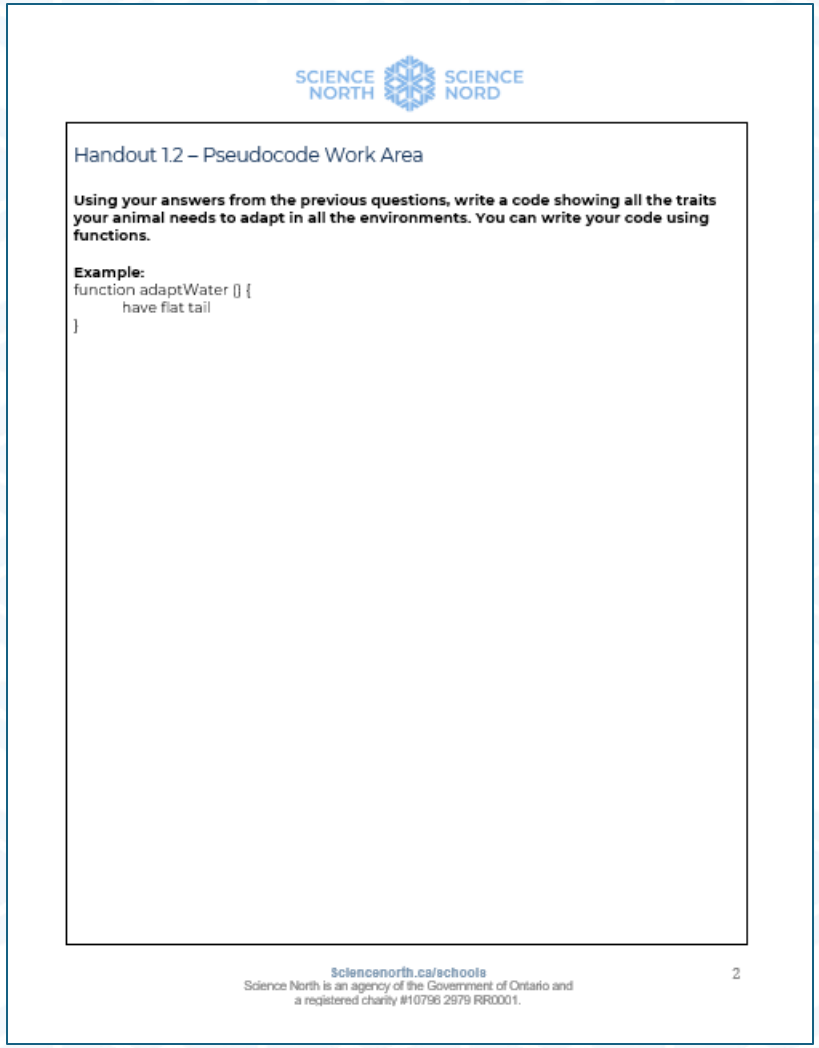
Handout 1.1 – Starting Questions

Answer the questions below to help plan out what characteristics your animal needs to adapt in every environment.

1. What conditions does your animal need to adapt to in a Desert?
2. What conditions does your animal need to adapt to in an Ocean?
3. What conditions does your animal need to adapt to in a Cave?
4. What conditions does your animal need to adapt to in a Forest?
5. What conditions does your animal need to adapt to on the Mountains?

Handout 1.2

On your handout in the provided space, write down a code representing the genome of your animal. The code will indicate the traits your species is going to have to overcome every environment. You will write the code using functions. The next slides will explain and demonstrate how to write a function.



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Handout 1.2 – Pseudocode Work Area

Using your answers from the previous questions, write a code showing all the traits your animal needs to adapt in all the environments. You can write your code using functions.

Example:

```
function adaptWater () {
        have flat tail
}
```

How to write a function?

A function is a block used to perform a specific task when it is called.
You will create a function for each adaptation your animal will have.
It can be written in this format:

```
function Name () {
Body
}
```

Name is what you will call the function. You will write it (or call it) in your code when you want to use the function.

The Body in between the brackets {} is the code your function will follow when it is called.

Examples of functions

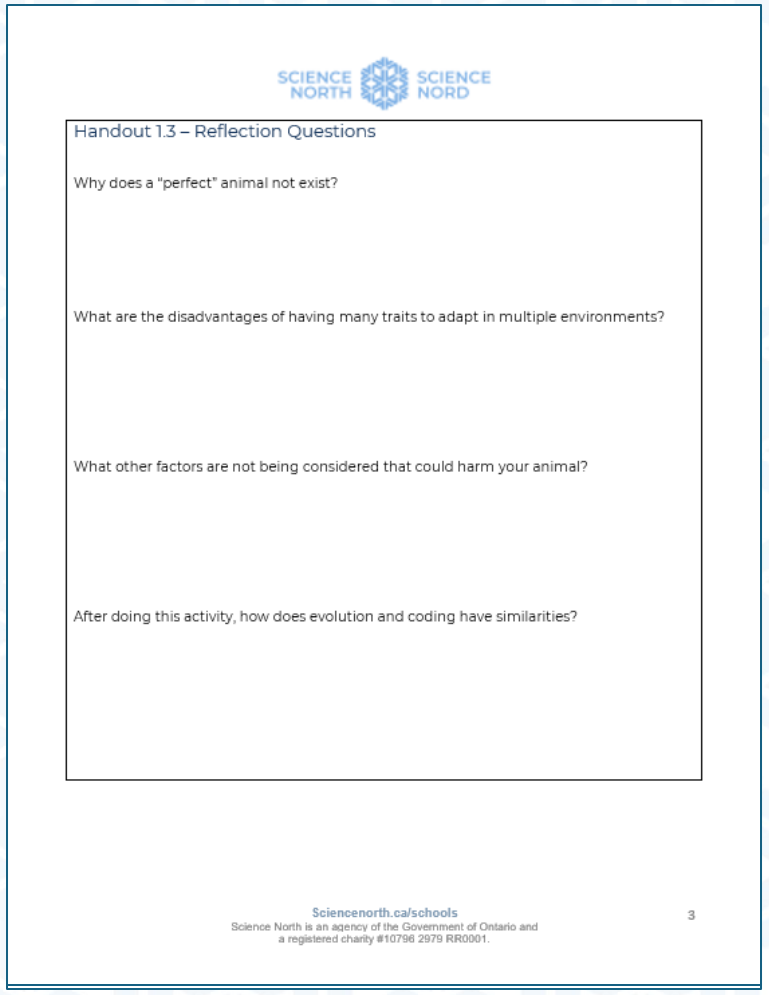
```
function adaptCold () {
        have thick fur
}

function adaptWater () {
        have flat tail
}
...

adaptCold
adaptWater
...
```

Define your functions and their codes

Call the name of your functions in your code

Handout 1.3

Write an answer for each of the reflection questions. Think of the strong points and challenges you have faced during the activity. Once every question has been answered, go to the next slides to discuss your answers with the rest of the group.



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Handout 1.3 – Reflection Questions

Why does a "perfect" animal not exist?

What are the disadvantages of having many traits to adapt in multiple environments?

What other factors are not being considered that could harm your animal?

After doing this activity, how does evolution and coding have similarities?

Why does a “perfect” animal not exist?

- Evolution’s goal is to adapt to the current environment, not to be perfect.
- Some traits that are advantageous in some places might be a harmful in other environments.
- The environment is always changing, and new challenges are introduced

What are the disadvantages of having many traits to adapt in multiple environments?

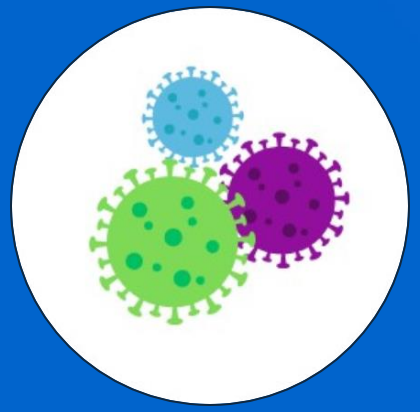
- A complex animal may have a higher demand for resources to survive, which can be difficult to obtain in areas with limited resources.

- Certain traits could oppose one another and waste energy, or some traits might be harmful if the animal is in a certain environment.
  - Flippers may not be helpful to navigate on land
  - Having a thick fur coat could cause the animal to overheat in a hot, dry area.

What other factors are not being considered that could harm your animal?

Mutations

Diseases



Age

Environmental change

After doing this activity, how does evolution and coding have similarities?

- Animals are coded by their genome, which “programs” the way they develop and function.
- An animal’s genome changes with evolution to adapt in their environment, like how one would debug their code to work the way they want it to.

Resources

Giraffe evolution. https://www.science.org/content/article/odd-creature-ancient-ancestor-today-s-giraffes

Mammal cladogram. https://research.amnh.org/paleontology/perissodactyl/node/55

Finches. https://ebird.org/explore

Desert. https://science.howstuffworks.com/environmental/earth/geology/largest-desert-in-world.htm

Ocean. https://eos.org/articles/deep-ocean-cooling-may-have-offset-global-warming-until-1990

Forest. https://www.climate-kic.org/opinion/getting-the-best-from-our-forests-five-ways-to-manage-them-well/

Mountain. https://www.livescience.com/how-tall-can-mountains-get.html

Cave. https://www.nationalgeographic.com/science/article/caves